Proceedings of Observatories.

The following Reports of the proceedings of Observatories during the past year have been received by the Council from the Directors of the several Observatories.

Royal Observatory, Greenwich.

The general meridian work at the Royal Observatory during the past year has gone on with the same regularity as in former years, special attention having been given to the observation of the Moon on every favourable opportunity throughout the lunation, and to the Sun, planets, and fundamental stars when they have passed the meridian before 15^h. The larger minor planets have also been observed about the time of opposition, when practicable. The Working Catalogue of 2600 stars, alluded to in former Reports, including all stars down to the fifth magnitude, and others required for various purposes, is now nearly cleared off, and a new Working Catalogue is in preparation, including all the stars down to the sixth magnitude contained in Dr. Heis's *Atlas Cœlestis*, which had not been previously observed at Greenwich with the Transit Circle. Comet *a* 1882 (Wells) has been observed twelve times on the meridian *sub polo*, and Comet *b* 1882 (the Great Comet) three times.

The mean error of the Moon's tabular R.A., from observation with the Transit Circle in 1882, is $+0^s.82$.

Two new determinations of the flexure of the Transit Circle were made in 1882, on January 2 and December 30, the resulting values being respectively $+0''.03$ and $-0''.07$. No correction for flexure, as determined by the collimators, has been applied to the observations.

In order to extend the range of the reflexion observations of stars, which, owing to the interference of the two collimators, had been hitherto limited to within an arc of 40° from the zenith, and thus to obtain data for determining the true law of the R−D discordance, a new arrangement of the mounting of the collimators was carried out in the summer of 1882, in which the collimators are mounted on upright arms turning about centres below. This allows them to be swung on one side when not in use, the piers being cut away so as to offer no obstruction to reflexion observations as far as Z.D. 71° on each side of the zenith. The importance of this extended range of reflexion observations is shown from an examination of the mean discordances of (R−D), which, for last year, steadily increase from

the zenith to Z.D. 70°, at which point the discordance between direct and reflexion observations amounts to 1″·6.

Notwithstanding this fundamental change in the mounting of the collimators, their stability from day to day is found not to be sensibly affected; but, as a matter of precaution, it is usual to place the corresponding wires of the north and south collimators in coincidence immediately before and after each determination of the collimation error of the Transit Circle. There is rarely any sensible difference between the two sets of readings.

With the Altazimuth the Moon has been observed at every practicable opportunity, on the same system as in former years, to the end of the lunation on 1882, July 9. Since this date the observations have been restricted to the first and last Quarters of each lunation, as it has been shown by a comparison of the number of observations made with the Transit Circle and Altazimuth, that the intermediate semi-lunation, before and after Full Moon, is well represented for all practical purposes by the daily observations made on the meridian. Advantage has been taken of this arrangement to devote greater attention to the observation of comets and other miscellaneous phenomena with the Equatorials, &c. In order to adopt the Altazimuth to the observation of comets, a new system of wires, having central cross wires thicker than the others, was inserted at the beginning of the present year.

Comet *a* 1882 (Wells) was observed on five days with the Naylor Equatorial, Comet *b* 1882 (the Great Comet) on eight days with the Sheepshanks Equatorial, and Comet *c* 1882 (Barnard) on one day with the S.E. Equatorial. Comet *b* was also observed on one day with the Altazimuth. The resulting apparent R.A. and N.P.D., together with the mean places of the comparison stars, are published in the *Monthly Notices* for November. Micrometric measures of the positions of six of the satellites of *Saturn*—*Enceladus*, *Tethys*, *Dione*, *Rhea*, *Titan*, and *Iapetus*—have also been made on several evenings with the S.E. and Sheepshanks Equatorials.

Twelve occultations of stars by the Moon have been observed in 1882, and also eighteen phenomena of *Jupiter's* satellites.

The solar eclipse of May 16 was favourably observed with the S.E. Equatorial, and four series of differences of R.A. and N.P.D. of the cusps and limbs were obtained. The plan of observation was so arranged as to give corrections to the tabular R.A. and N.P.D. of the Moon, and to the adopted semi-diameters of the Sun and Moon. During the eclipse, which at its greatest phase only covered 0·186 of the Sun's disk, eighteen differences of R.A. of cusps, ten differences of N.P.D. of limbs, and nine differences of N.P.D. of cusps, were observed. The times of the beginning and ending of the eclipse were also recorded by several observers.

The spectroscopic observations have been made as usual

with the "half-prism" spectroscope mounted on the S.E. Equatorial. The routine observations have been less numerous than usual, partly owing to the cloudy weather of the latter half of the year, and partly to the pressure on the Photographic department from the increase in the number and size of the Sun-spots as the period of maximum solar activity is approached. The spectra of various Sun-spots have been examined on ten days; the great Sun-spot of November last being especially remarkable for the instances of reversal of lines which it displayed. The examination of the chromosphere for prominences has been made on twenty-two days, and numerous prominences were seen on each occasion.

The displacement of the F or *b* lines has been measured in the spectra of thirty-one stars. This work has suffered some interruption during the period of observation of Comets *a* and *b*, the former of which was examined with the spectroscope on eight occasions, and the latter on three. The single-prism spectroscope has also been employed on one night for the measurement of the positions of the bands in the spectrum of *Uranus*, and the "experimental half-prism" spectroscope was employed on the night of November 17 in the examination of the spectrum of the Aurora. All the spectroscopic observations have been completely reduced to the end of 1882.

Photographs of the Sun have been obtained with the photoheliograph on 201 days during the year; whilst in 1881 they were taken on 173 days. This increase is due to arrangements having been made for securing photographs on Sundays. The increased number of photographs, and, still more, the remarkable increase in the number and size of the Sun-spots, have rendered the work of their measurement and reduction much more severe than in previous years. The reductions have, however, been considerably lightened, without any real loss of accuracy, by limiting the calculations to tenths of a degree instead of to minutes. The photographs have been measured in duplicate to the end of 1882, and completely reduced to 1882 October 8.

Arrangements have been made with the Solar Physics Committee by which the gaps in the Greenwich series of Sun-pictures will be filled up as far as possible by photographs taken at Dehra Dûn (India) and elsewhere, thus rendering the series practically continuous. Seventy-nine photographs dating from 1881 December 22, to 1882 June 30, have already been received from the Committee and of these thirty-six, up to 1882 March 8, have been measured in duplicate, and twenty-eight, up to 1882 February 20, have been completely reduced.

The reductions of the observations in every department are in a forward state, and the complete copy of the observational sections of the volume of *Greenwich Observations* for 1882 will shortly be ready for the printer. The printing of the *Greenwich Observations* for 1881 is nearly finished, the whole of the volume being in type, and it is hoped that it will be ready for distribu-

tion in the spring. The separate copies of the Results of the Spectroscopic and Photographic Observations for 1881 have been already distributed in advance of the volume.

Armagh Observatory.

By the Act of Parliament (Irish Statutes, 31 George III., ch. 46) "for settling and preserving a Public Observatory in the city of Armagh," the appointment of the Astronomer is vested in the Archbishop of Armagh, while the Observatory is under the control of a Board of Governors and Guardians, of whom the Primate is Chairman.

On February 28, 1882, the Rev. T. R. Robinson died, after having had charge of the Observatory for more than fifty-eight years. In June the Primate appointed Dr. J. L. E. Dreyer to succeed Dr. Robinson; but as extensive repairs to the dwelling-house were necessary, Dr. Dreyer did not take up his residence at the Armagh Observatory till August 31.

The principal instruments now in use are:—

1. A Mural Circle by Jones, with a telescope of seven inches aperture by T. Grubb, and two collimators.

2. A Chronograph by Knoblich (clock movement improved by Grubb).

3. A 15-inch Reflector by T. Grubb, mounted equatorially with clockwork; can be used either in the Newtonian or the Cassegrain form.

4. A 3·8-inch Refractor by Jones, on a portable Equatorial Stand.

5. Three Sidereal Clocks (one with barometer compensation); one Mean Time Clock.

The Transit Instrument, with which the R.A.'s of the Armagh Catalogue were determined, has not been in use for the last twenty years, but is in good order. A 12-feet Zenith Sector (formerly at Kew) has lately been dismounted. Besides several minor instruments (a sextant, two theodolites, &c.), there are a number of old instruments which now only possess historical interest.

Since 1864 the Mural Circle has been employed to determine the places of a number of stars from Lalande-Baily's Catalogue. Close upon 3,000 stars have been observed, most of them from three to five times. These are now being prepared for publication as a second Armagh Catalogue, for 1875, a grant having been obtained from the Royal Society for the purpose of printing this.

With the Reflector the ingress of *Venus* on the Sun's disk was successfully observed (see *Copernicus*, January 1883). If the steps which are now being taken to procure for the Observatory an Equatorial Refractor should prove successful, it is

intended to devote this instrument to micrometrical work, and probably to try Cluster Photography with the Reflector.

The self-recording meteorological instruments established in 1868 have been working without interruption.

By order of the Board of Governors a history of the Observatory has been drawn up, and is now about to be printed in pamphlet form.

Cambridge Observatory.

As in former years, our attention has been specially given to the Zone observations with the Transit Circle, and the reductions have been carried on with great assiduity. The True Right Ascensions and the True North Polar Distances are calculated up to the end of 1881, and Tables are in course of preparation, not only for reducing the places to the Mean Equinox at the beginning of each year, but also for again reducing these results to 1875·0, which is the epoch chosen by the German Astronomische Gesellschaft.

These observations have, however, on several occasions been interrupted by the fine comets which have recently attracted so much attention.

Comet *Wells*, 1882, was observed on twenty-four nights, from April 5 to May 31 inclusive, with the Northumberland Equatorial and Square Bar Micrometer, and fourteen times with the Transit Circle: and a very satisfactory parabolic orbit was obtained by Mr. Graham from the observations of April 5, 14, and 22.

The Great Comet 1882 (*b*) was compared 159 times with neighbouring stars from October 25 to December 6 inclusive.

All these observations have been reduced and communicated to the Royal Astronomical Society, with the exception of the fourteen meridian observations of the Comet *Wells*.

The bad weather entirely prevented any observation of the Transit of *Venus* being made at this Observatory.

Dunsink Observatory.

During the past year there has been a change here, owing to the appointment of Dr. J. L. E. Dreyer, to succeed the late Dr. Robinson at Armagh. The vacancy thus made has been filled by the appointment of Mr. Arthur A. Rambaut, of Trinity College, Dublin.

The Chronograph is now in good working order, and meridian observations of the selected list of stars are in progress (see Report last year). The Equatorial has, as before, been chiefly employed in researches on Annual Parallax. The series for Σ 2486=6 *β Cygni* has been completed and discussed, and the

result shows that this star has a parallax of $0''.482 \pm 0''.054$. The series of observations on μ *Cephei* has been finished, but the results are not yet ready for publication.

During the autumn, observations of *Victoria* and of *Sappho* were made in conjunction with those simultaneously made by Mr. Gill at the Cape for the determination of the Solar Parallax.

The Transit of *Venus* was seen to some extent. Clouds obscured the contacts, but micrometrical measures of the distances of the limbs were obtained.

Part IV. of our publications was distributed last year. Part V. has gone to the press. It will contain a detailed account of the Parallax work with the Equatorial.

Royal Observatory, Edinburgh.

The work of daily time-signals, by both ball, gun, and controlled clocks, with the necessary observations, have been carried on as usual through the past year; likewise the calculations of the bi-diurnal meteorological observations at 55 of the stations of the Scottish Meteorological Society, for the Registrar General of Scotland, and have been printed in his monthly and quarterly returns.

In the course of last July the Government made a grant of money towards binding the many unbound pamphlets belonging to the Observatory; and assured the Astronomer that they had the resumption of printing the Star Catalogue and the repair and completion of the instruments, as recommended by their Commissioners of Inquiry in 1876 and 1879, under their serious consideration.

Glasgow Observatory.

Apart from the ordinary operations connected with the transmission of Greenwich Mean Time to the city and port of Glasgow, there is only to report, in connection with the past year, the final passing through the press of the Glasgow Star Catalogue, which is expected to be ready for distribution in two or three weeks. The Glasgow Observatory was one of the few favoured places in the British Isles where an observation of the ingress of *Venus* on the Sun's disk was obtained on the 6th of December, 1882.

Kew Observatory.

Sun-spot observations on Hofrath Schwabe's method have been made on 197 days. The Sun's surface was found to be free from spots on three of those days.

A small portable $2\frac{3}{4}$-inch refracting telescope, with a magnifying power of 42 diameters, was used by the observer till July 3; since that date the observations have been made by means of the Photoheliograph, which was removed from the Loan Collection at South Kensington for that purpose, and reinstated on the pedestal in the Dome, a position which it occupied prior to its being sent to the Royal Observatory, Greenwich, in 1873.

The spots are now drawn by the observer, as they appear projected upon the focussing screen.

The measurements and reductions of Sun-spot positions and areas, as determined by means of the Kew Photoheliograph, from 1864 to 1872, having been completed for Mr. De La Rue, he has deposited the manuscript with the Council of the Royal Society.

Preparations were made with a view to obtain photographs of the Transit of *Venus*, but clouds prevented any being taken.

The usual magnetical and meteorological observations and reductions have been carried on as formerly.

Liverpool Observatory, Bidston, Birkenhead.

During the past ten years between two and three thousand chronometers have been tested at this observatory in three definite temperatures. The temperature is changed fifteen degrees at the end of each week in the following order: 55°, 70°, 85°, 70°, 55°. The object of changing the temperature in this way is to show the amount of variation in the rate due to change of temperature apart from the change of rate arising from other causes, and in this way to obtain the data necessary for calculating the corrections to the rates due to change of temperature by the formulæ published in the Report on this Observatory for 1872. The thermal factor ranges in different chronometers from about 0·001 to 0·004, the average being 0·0025. With this factor, when the maximum gaining rate is at 70°, the change of rate due to change of temperature between 40° and 100° is $2^s{\cdot}5$ a day; but if the temperature of maximum gaining rate should be 30° on either side, 70° the change of rate between 40° and 100° amounts to $9^s{\cdot}0$ a day. There is no difficulty in correcting the rates for error of thermal adjustment, and the change of rate arising from other causes can be detected and allowed for at sea by daily comparisons of the chronometers with each other, and by occasional observations of well-known points of land.

There are now deposited at this Observatory the records of upwards of one hundred voyages from Liverpool to and from the west coast of South America. Each ship carried three chronometers, and the Greenwich time, carried on by rates corrected for change of temperature, has been recorded daily

throughout each voyage. Numerous observations have also been made by the officers of the Pacific Steam Navigation Company for checking the chronometers at intervals during the voyage. The results show that by keeping such records it is practicable to render chronometric navigation sensibly perfect.

The meteorological observations obtained from the self-recording instruments have been tabulated, and telegrams have been sent daily to the Meteorological Office and to the Liverpool Underwriters' rooms.

Radcliffe Observatory, Oxford.

Observations have been systematically made with the Transit Circle throughout the year 1882.

The number of observations is as follows:—

Transits	2117
Circle Observations (each requiring the reading of the four microscopes)	2189

These totals include—

	In R.A.	In N.P.D.
Observations of Sun at Solstices and Equinoxes	32	29
Observations of Moon	54	56
Comet *a*, 1882	15	16
Reflexion Observations of Stars ...	—	109

and

162 pairs of Nadir Observations.

No opportunity was afforded of observing the time of passage of the Moon's diameter during the year, but 17 measures of the vertical diameter have been secured.

Two new wires were inserted by Mr. Simms on Oct. 2, and the equatorial intervals of the whole system have been carefully redetermined. An investigation of the flexure of the telescope has recently been made. The value found was almost identical with that which has been in use since 1880, June.

The current reductions are in a forward state, the N.P.D.'s being completely, and the R.A.'s very nearly, reduced up to date.

The Astronomical Results for 1880 have been printed.

The observations for 1881 have been discussed, and are being prepared for press. Following the plan adopted at the Cape, the Nadir Points have been exclusively determined with the Nadir reflecting eyepiece; but frequent observations of stars by reflexion, north and south of the zenith, have been made as a check upon the existence of any systematic errors.

From 27 Northern stars with 56 reflexion observations and 57 direct observations the value of R—D is

$$-0''.222;$$

whilst from 34 Southern stars with 77 reflexion observations and 108 direct observations the value of R—D is

$$+0''.013.$$

The mean discordance between the Nadir Points determined from the wire observations and from the star is therefore only

$$-0''.08.$$

The colatitude found from observations made during the year 1881 is

$$38^{\circ}\ 14'\ 25''.05;$$

but if the Nadir Points used had been those deduced from reflexion observations of stars alone, the colatitude would be

$$38^{\circ}\ 14'\ 24''.95.$$

The difference between these results is small, and the uncertainty of the colatitude determination of the year is therefore confined within very small limits.

A series of Northern stars which have been used in the determination of differences between the longitudes of the Cape Observatory and Aden have been under observation here at the request of Mr. Gill.

Seventeen observations of phenomena of *Jupiter's* satellites, seven of occultations of stars by the Moon, and the eclipse of the Sun on May 16 have been made with the extra-meridional instruments.

The Meteorological Results for 1880 have been printed and distributed, and those for 1881 are being discussed.

In addition to the regular work of the Observatory the grounds have been made available for the erection and trial of the instruments of the different Transit of *Venus* expeditions which were sent from this country, and for a comparison of the clock errors of the different observers with those of the Standard Sidereal Clock as determined by the Observatory staff.

The sky was clouded here generally during the time of the Transit, but a view of *Venus* well on the Sun was obtained during a short break in the clouds.

Oxford University Observatory.

The whole strength of the Observatory has been, without intermission, directed to the photometry of the brighter stars from the Pole to the Equator, including a few stars of inferior brightness, or of southern declination, but possessing interest. This work was substantially completed in December last; a few stars remaining for re-observation. Professor Pritchard has taken one of the two telescopes, and its photometer used for the above purpose, to Cairo, in order to complete the Memoir, in respect of the atmospheric and climatic effects on the apparent brilliancy of stars. The more interesting results of the general photometric work have been communicated to the Society during the past year.

In the *Memoirs* of the Society will be found a communication on the Photographic Diameter of the Moon, which, it is believed, establishes the applicability of photography to astronomical measurements of the most delicate character. There still remains in the Observatory a research, all but ready to be submitted to the Society, on the relative positions of the brighter stars in the group of the *Pleiades* observed with the Duplex Micrometer.

Arrangements were made for the observation of the Transit of *Venus* by several observers with telescopes of various apertures, but unfortunately without avail, owing to unfavourable weather. Notwithstanding the unpromising nature of the day, some fifty members of the University assembled at the Observatory, remaining there until sunset in patient hope of at least a glimpse of the planet on the Sun, which would have been exhibited after the manner of Horrox's historical method of projection.

It is right to acknowledge the continuance of the very cordial assistance of the Board of Visitors, and the zealous aid of the assistants, Mr. W. E. Plummer and Mr. Jenkins. The latter accompanies Professor Pritchard to Cairo; the former is left in charge of the Observatory during his absence.

Stonyhurst College Observatory.

During the past year the entire chromosphere has been measured on 70 different days. Two hundred and twenty-one drawings of the solar spots have been made in the usual manner, and several enlarged drawings of the more remarkable spots and groups have been made to a scale of 30 inches to the solar diameter.

The observations of *Jupiter's* satellites, and of occultations of stars by the Moon, have been continued as in previous years.

Owing to the badness of the weather, the position of Comet

b, 1882, was observed only a few times with the 8-inch Equatorial. Four transits of the comet across the meridian were observed.

The solar eclipse of May 16 was well observed both with the spectroscope and telescope.

Temple Observatory, Rugby.

The measurement of position and distance of double and multiple stars has been continued as usual during the past year, and 255 complete sets of measures of 105 stars have been made, so that each star has been measured on either two or three different nights.

The Observatory has been open on 77 nights, but in this are included a few cloudy ones, when opportunity was taken to go through the finding of instrumental errors with the most advanced boys.

Some attention has been given to the measurement of recession and approach of stars with the spectroscope on the Reflector, and the comet was observed several times, and drawings were made of it.

Mr. Percy Smith made some excellent drawings of the large Sun-spots in November.

Mr. Barclay's Observatory, Leyton, Essex.

The ordinary routine work has been carried on as usual. Measures of double stars and observations of planetary satellites have been made.

Mr. Talmage left, in October 1882, for Barbadoes, to observe the Transit of *Venus*, and will not return till the middle of February. During his absence only some meteorological work is carried on.

Mr. Campbell's Observatory, Arkley, Barnet.

The observations of the Moon are still continued at this Observatory, with a view to the determination of the distance of the Sun by means of the parallactic inequality.

This year's work has been much interrupted by an accident and by absence from home.

The analytical part is in a forward condition, as applied to the 134 observations taken before the end of 1882, and will, it is hoped, be still carried on by Mr. Neison.

every fortnight, and it is hoped that this part of the activity of the Observatory may be extended during the coming year.

Some time was also spent in gaining experience in photography, and a photographic eyepiece has been ordered for the large Refractor, with which it is intended to photograph Sun-spots and other phenomena.

A Rain-band Spectroscope was also added to the instrumental outfit during the autumn, as well as Browning's Solar Eyepiece.

The Earl of Crawford's Observatory, Dun Echt.

The greater number of the observations made at this Observatory during the past year, refer to comets.

Comet *Wells* was observed for place on ten nights, while its spectrum was examined on several occasions, and measured on five nights. This is the first comet which showed, besides the usual hydrocarbon bands, also the sodium lines. The presence of the latter in the spectrum was first noticed on May 27, but the real nature of the line was only recognised on the following night, when it was already much brighter, and found to coincide exactly with the sodium line of a spirit-lamp. Several attempts were made to find the comet at and after perihelion passage, but in vain.

The comet which seems only to have been seen during the total eclipse of the Sun on May 16, was also searched for in the twilight, but without success.

Also the attempts to find the Great Comet, notice of which had been telegraphed by M. Cruls, failed, and but for the telegram obligingly sent by Mr. A. A. Common it is not improbable that it might have escaped notice on Monday, September 18, although, with attention drawn to it, it was easily seen in spite of its nearness to the Sun. The spectroscopic observations secured on that day deserve mentioning. They prove also in this comet the presence of great quantities of sodium vapour, and, what is more important, they leave little or no doubt that also vast masses of iron vapour existed on that day in the comet, and moreover they furnish a splendid proof of Doppler's theory by the observed displacement of all the sodium and iron lines towards red. The unfavourable state of the weather permitted only on two other occasions measurements of the spectrum of this most interesting comet. The details of the spectroscopic observations were published in *Copernicus*.

Of Comet *Barnard*, 1882, only two places were secured.

The eclipse of the Sun on May 16 was observed both with 15·06-inch Grubb Refractor and with the 6-inch Simms Refractor.

With the 15·06-inch Refractor also a fairly satisfactory observation of the Transit of *Venus* was made.

Dr. Copeland having been appointed chief of the Government

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Transit of *Venus* Expedition to Jamaica, the instruments and houses lent by Lord Crawford for the expedition were put into good order during the summer, and other necessary preparations made. Dr. Copeland, having started from Dun Echt on October 7, and obtained good observations of the Transit of *Venus* at Jamaica, is expected to return in a few months.

During the year twenty-three Circulars—Nos. 45 to 67—all printed at the Observatory, were distributed. With the exception of No. 53 they all relate to comets. Besides observations they contain fifteen sets of elements and about the same number of ephemerides. Nearly all the telegraphic informations, received and sent, were transmitted by the "Science Observer Code," which answers its purpose admirably. In spite of the inevitable mutilations of some of the words, every message could be perfectly deciphered.

The reductions of the observations are in a forward state.

Considerable progress has been made in the printing of observations connected with the Transit of *Venus* in 1874.

The arrangements respecting the time-gun, time and meteorological observations remain as before.

Mr. Edward Crossley's Observatory, Bermerside, Halifax.

There has been no change in the observational work of this Observatory since the last report. The measurement of double stars and the phenomena of *Jupiter's* satellites have received the largest share of attention. The weather of 1882 was exceptionally bad here, and the observations were much interrupted.

Mr. Huggins' Observatory, Upper Tulse Hill.

The following is a summary of the work of this Observatory during the past year:—

(*a*) On March 7 a photograph of the spectrum of the great nebula in *Orion* was obtained. The spectrum extends from a little below F to beyond M in the ultra-violet. The photographic plate shows a spectrum of bright lines, and also a narrower continuous spectrum probably due to stellar light. The bright stars forming the trapezium in the fish's mouth of the nebula were kept close to the side of the slit, so that the light from the adjacent brightest part of the nebula might pass to the plate. Outside this narrow continuous spectrum a very faint continuous spectrum is suspected. The photograph shows faintly but satisfactorily the four bright lines discovered in the nebula by Mr. Huggins in 1864, and beyond these known lines, in the ultra-violet a new line of great relative strength which has a wave-

length of about 3730. This line appears to correspond to ζ of the typical spectrum of the white stars obtained by Mr. Huggins.* Very faint lines are suspected in the spectrum between Hγ and λ 3730, and also, possibly, beyond λ 3730.

(*b*) On the evening of May 31, a photograph of the spectrum of Comet I. (Wells) was obtained, a comparison spectrum of *α Ursæ Majoris* being taken on the same plate.

The photograph shows a strong continuous spectrum extending from about F to a little beyond H. For the first time since spectrum analysis has been applied to the light of comets, the visible spectrum of this comet consisted principally of bright lines including those of sodium, the usual carbon bands being excessively faint. So also the photographic spectrum differs from that which Mr. Huggins obtained of the bright comet of 1881. The cyanogen group in the ultra-violet, and other lines probably due to carbon, are not to be seen in the photograph, but five brighter spaces between F and H probably indicate groups of bright lines. The positions of the brightest parts of these groups are—

λ 4764
4634
4507
4412
4253

(*c*) From the end of May till September 28 a series of photographs of the Sun was taken under conditions which it was expected would enable the corona to be obtained upon the plates. The slit photographs taken in Egypt on May 17 had shown that the corona light is very strong from about G to H. It appeared probable to Mr. Huggins that by cutting down the Sun's light to this part of the spectrum, and by the use of photography which is very sensitive to minute differences of illumination, those parts of the atmospheric glare which have the corona behind, might be sensibly stronger in the photographs than the parts of the atmospheric light where no coronal light is present.

The photographs were taken with a reflecting telescope by Short, $3\frac{1}{2}$ feet focal length, arranged as a Newtonian, the aperture being reduced to 3 inches. The light was restricted to the small range of refrangibility of from about G to H, by means of screens of coloured glass, and also by a cell containing a strong solution of potassic permanganate. These screens were placed immediately in front of the sensitive surface. The gelatine plates were backed with asphaltum dissolved in benzole. Very different exposures were given. In about twenty plates an appearance peculiarly coronal is seen about the Sun. This does not consist merely of increased photographic action about the sun, but shows distinct forms which were found to accord well with those

* "Photographic Spectra of Stars," *Phil. Trans.* 1880, part ii. p. 669.

in the plates taken in Egypt. In the longer exposed plates the outer corona with its rays of varying length and peculiar rifts is seen; in the plates with a shorter exposure the inner corona, which is more nearly uniform in height, may be seen under suitable illumination. The average heights of the outer and inner coronæ agree closely with the coronæ as seen on the plates taken in Egypt.

On account of the great importance of these results, Mr. Huggins was desirous of having his own opinion confirmed as to the reality of the coronal forms on his plates. Professor Stokes and Captain Abney kindly examined them with much care, and have permitted him to say that in their opinion the corona has really been photographed without an eclipse.

The great Equatorial (belonging to the Royal Society) has been dismounted for improvements since June. It has, therefore, been impossible to continue photographic work on the spectra of the stars and nebulæ; and for the same reason no observations of the great comet of last autumn could be made.

The Earl of Rosse's Observatory, Birr Castle.

The year 1882 was more unfavourable than usual for astronomical work, observations having been made on forty nights only during the ten months in which the assistant was at his post. On 321 nights clouds were recorded at 9 p.m., and 335 nights were classed as more or less cloudy. Rain also is recorded to have fallen on 221 "days." The months of April and May, however, during which Dr. Boeddicker was absent in Germany would, if included, have somewhat increased the proportion of observing nights.

Three sketches of the planet *Mars* and six of *Jupiter* were made during the year with the 3-foot Reflector; also thirty-four sets for nebulæ were made with the 6-foot Reflector.

Some sketches of Comets *b* and *c*, 1881, and of the planet *Jupiter* in the season 1880–1, were published in the course of the year by the Royal Dublin Society; and a series of eighteen sketches of the planet *Mars* when last in opposition are in course of publication by that Society.

A series of sketches of the planet *Jupiter*, made during the season 1881–2, is in our portfolio.

Some lunar-heat determinations, made at intervals by Dr. Boeddicker are in process of reduction, and will probably be employed to confirm, or modify, as the case may be, the extinction and lunar-phase curves, as given by Dr. Copeland.

The Transit of *Venus* of December 6 was seen occasionally with the 3-foot between clouds, the enlarged image being projected upon a screen, but the Sun was invisible at the times of the contacts.

The meteorological observations have been made without interruption the same as last year.

A new polishing machine for 3-foot specula was constructed during the year. It is very similar in general mechanical arrangement to that sent out with the great Melbourne Reflector.* It has, however, been fitted for giving, in addition to the circular and straight strokes hitherto commonly employed, other motions with different relative times of rotation of the two excentrics as in Lassell's last machine.† The machine at its first trial, when the relative velocities of the excentrics were as 104 to 155 and their respective throws $\frac{1}{4}$ and $\frac{1}{3}$ the diameter of the speculum, gave a very good result, and it is hoped that subsequent experiences may be equally satisfactory.

Though it forms no part of the Observatory work, it may be mentioned that Dr. Boeddicker has during the year devoted a considerable amount of time to a discussion of the numerous papers which have from time to time appeared on the influence of magnetism upon the rates of chronometers. It is hoped that the paper, which is being published by the Royal Dublin Society, may be useful to succeeding workers on the subject.

Mr. Wilson's Observatory, Streete, Rathowen.

During the past year the mounting of the silver-on-glass Reflector of 2 ft. aperture by Grubb has been finished in the new Observatory. Observations have been made of the satellites of *Uranus* and *Saturn* and Comet *Wells*. The Transit of *Venus* was well observed in a cloudless sky. Six minutes after first contact the planet could be seen projected against corona, and surrounded by a ring of light. Internal contact $1^h\ 52^m\ 14^s$ S.M.T. No black drop. A series of observations in the infra-red end of the spectrum of different parts of the Sun's surface have been undertaken, and it is hoped that some of the results will be laid before the Society during the year.

* *Phil. Trans.* vol. clix.
† *Ibid.* vol. clxv.